EMBRYOLOGY.[1]

Sexually Produced Organisms without Maternal Characters ?—When it was announced by Boveri[2] than an organism might be formed from a fragment of an egg fertilized by sperm of another species and then possess only the characters of that latter paternal species, this fact naturally gave rise to much speculative application, and was welcomed as evidence of the great value to be set upon the nucleus in the processes of heredity. Boveri stated that bastard larvæ formed by sperm of *Echinus microtuberculatus* and eggs of *Sphaerechinus granularis* were in all respects middle forms between the species. He also stated that when the eggs of the latter species were shaken so that they broke and lost their nuclei and were then fertilized by the sperm of the former, dwarf larvæ were formed that had the characters of the male parent, Echinus, only, and not those of the female parent, Sphærechinus. Thus, he concluded, the male sperm nucleus transmitted paternal characters, while the egg protoplasm, deprived of its nucleus, gave none of the maternal characters to the offspring.

Oswald Seeliger[3] has repeated these experiments with the same species and has shown that Boveri's conclusions are not the necessary ones to be drawn from the evidence, but only interpretations that ignore most weighty factors.

In two plates he gives careful figures of the larvæ of both species at the same stages and also figures of the bastard larvæ. An examination of these convinces one that the normal bastards, or those from whole eggs, are not by any means exactly intermediate between the two parents in all cases. Many do combine the parental characters in this way, but many are much like the father and others more like the mother. This holds both for the general shape and for the structure of the larval skeleton.

Since then, many bastards from whole eggs resemble the father, there is no proof that the bastards from broken eggs were not also from nucleated pieces, for it must be borne in mind, that Boveri failed to get larvæ from isolated fragments, and obtained his dwarf larvæ from the

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] See American Naturalist, March 1, 1893.

[3] Roux Archiv. f. Entwicklungsmechanik. I, 2, Dec. 11, '94.

general mixture of nucleated and non-nucleated fragments that are to be found when the eggs are shaken in a test tube.

Boveri also observed that the dwarf larvæ had small nuclei, coming as he supposed from the male nucleus only, not from two fused nuclei as in ordinary fertilization. This reason is also fallacious since Seeliger finds a great deal of variation in the size of the nuclei in the normal bastards from whole eggs. The small nuclei may come, then, from eggs with nuclei and do not give any evidence as to the absence of a nucleus in the egg fragment.

Again the bastards from the whole eggs vary much in size. In shaken eggs, however, Seeliger finds dwarf larvæ much more numerous than in the case of whole or unshaken eggs.

He concludes that though the fertilization of non-nucleated egg fragments may not be impossible, it is probable that the dwarf larvæ obtained by Boveri were merely the results of fertilization of broken eggs or egg fragments still retaining their nuclei.

Double Monsters.—To the same number of Roux's new periodical, Professor O. Schultze, of Würzburg, contributes some interesting results that he obtained by keeping frog's eggs in a forced position. The eggs of *Rana fusca* were fastened to glass slides and then fertilized and fixed between slides so that they could not revolve when turned upside down.

They were allowed to develop right side up till divided into two cells and then inverted and kept upside down till towards the beginning of gastrulation.

A detailed account of the methods and of the results of individual experiments is given.

It appears that a considerable number of the eggs thus exposed to the disturbing effects of gravitation developed into double monsters of various characters as shown in the two plates. Some developed two heads and two sets of gills on each.

The formation of these double individuals in place of the normal single one, is in some way due to the rearrangement of the substance of the cells when inverted and acted upon by gravity, so that the heavier part is drawn down and the lighter rises, as may be readily seen since it is dark colored. There is thus a modification of the egg substance that acts like a partial division of the egg and allows each of the two cells to develop somewhat as if isolated.

In a discussion of the general question of the formation of double monsters in nature, the author rejects the idea that abnormal or mul-

tiple fertilization is concerned or that subsequent events are the cause. The cause of double monsters lies in some abnormal state of the ovarian egg. This state of the egg may be like that that has in recent experiments produced double formations from half eggs; that is, the abnormality may be its division into more or less separate halves, each of which would form a complete individual if separated from the other.

Double individuals are thus to be regarded as coming from imperfectly divided ovarian cells; eggs similar to the somatic cells that are found with two nuclei. A complete division of the germ material produces separate individuals, a very slight division, double monsters; between these extremes are identical twins.

The formation of double monsters would be, in this speculation, a process of arrested development!

Fusion of Blastomeres.—Dr. Arnold Graf[4] briefly describes a remarkable case of retrogressive cleavage in the eggs of the sea-urchin Arbacia.

Some eggs compressed under a cover-glass after the method of Driesch, divided into flat plates of 16 cells that quickly passed into 32 (here some abnormal conditions may be suspected). When the pressure was removed by adding more water, the cells began to fuse so that their number became reduced to 15 and then 14! At first each has two or three nuclei according as it is made by the fusion of two or of three cells, but later the nuclei fuse and the cells change their positions and shapes. The same phenomenon was seen in a plate of 8 cells.

It is claimed that only those cells unite that are closely related: the daughter cells of one mother cell fuse together.

Unfortunately nothing is known of the possible future of such embryos nor of the effective causes at work in producing them, and so this notice serves more as a stimulus to work than as a contribution to our knowledge of the mechanics of embryology.

Temperature and Development.—Professor O. Schultze[5] finds that the eggs of *Rana fusca* may be kept in water at 0° C for 14 days when in the gastrula stage without losing the power to form normal embryos. During this period there is a complete cessation of development.

[4] Zool. Anz., XVII, Dec., 1894.

[5] Anat. Anz., X, Dec. 19, 1894.

These results are opposed to those of O. Hertwig who found that exposure to 0° C injured the eggs so much that they would not develop.

A Problematical Structure in a Mammal.—Dr. A. W. Weysse[6] in a very careful and well illustrated study of some thirty blastodermic vesicles of the pig, finds a remarkable ectodermic outgrowth arching over the germinal disk. The cavity beneath this "bridge" is never closed, and is eventually obliterated by the fusion of the "bridge" cells with the subjacent ectoderm.

The author thinks this structure has no homology in any thing as yet known among mammals, but may, perhaps, be compared to the dorsal growth in Amphioxus that forms the medullary canal, since they both agree in time of formation and in relations to the neurenteric canal and neuropore!

Development of Scyphomedusæ.—Ida H. Hyde has published the results of a most careful examination of the cleavage, gastrulation and the formation of the scyphistoma stage in several medusæ. The paper is illustrated by more than one hundred very careful and true figures and bids fair to clear up some much disputed points upon which the most noted investigators have held different views.

The material was obtained at Annisquam, Mass., at Eastport, Maine and from Johns Hopkins Marine Station in Jamaica, and was studied at Bryn Mawr, Woods Hole and Heidelberg.

The embryology of *Aurelia marginalis* from Jamaica had never before been studied; that of *A. flavidula* and *Cyanea arctica* had been, imperfectly.

The gastrulation of *A. marginalis* differs from that of all known Scyphomedusæ in that it is a process of delamination, that is, the blastula becomes converted into a closed two-layered larva by the division of some cells in such a way that their inner ends form an inner layer.

In *A. flavidula* the germ layers are formed in two different ways: eggs from Eastport, Maine, gave rise to the entoderm by a process of delamination combined with inwandering of cells from various parts of the blastula wall; eggs from Annisquam formed invaginate gastrulas.

In *C. artica* the gastrulation is a modified invagination in which some cells break loose from the pole that is invaginating; there is, however,

[6] Proc. Amer. Acad. Arts & Sci., XXX, 1894.

no trace of the multipolar inwandering of cells as described by McMurrich.

In the formation of the Scyphistoma it is found that the planula of *A. marginalis* settles down by the aboral pole which is peculiarly modified.

In all the species examined the mantle is a new formation and not a reopening of a gastrula mouth.

The inrolled part of the ectoderm remains as the œsophagus, and is not invaginated again, so that there is no doubt of the correctness of the views held by Goette regarding the ectodermal nature of this part of the digestive cavity.

The first pair of gastric pouches arises as a pair of outgrowths from the entoderm, but the second pair comes from the ectoderm.

The ectoderm thus takes part in the formation of the œsophagus, the septa and the gastral filaments as well as the second pair of the four original pouches.

Goette's views as to the relation of the Hydromedusæ and Anthozoa are thus strengthened by these observations.

Blastomeres of Medusæ.—Raffaello Zoja, of Pavia, has published a preliminary notice[1] of some most interesting work upon the development of isolated blastomeres of Medusæ and of other non-vertebrates. He finds that even $\frac{1}{16}$ of an egg, that is, one of the isolated cells when the eggs has divided into 16, is able to develop by itself into a perfect organism; it develops in the same way as a complete egg and forms as perfect an individual.

In *Clytia flavidula* $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ or $\frac{1}{16}$ when isolated develops into a hollow blastula in which entoderm arises by migration. A larva results that differs from the normal whole-egg-larva only in size. In the case of $\frac{1}{2}$ or $\frac{1}{4}$ egg the hydroid form was ultimately obtained. The larva probably has half as many cells as in the normal case.

In *Laodice cruciata* also $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$ or $\frac{1}{16}$ of the egg will grow into a perfect, but small swimming larva.

In *Mitrocoma annæ* $\frac{1}{2}$ or $\frac{1}{4}$ of the egg gives rise to a perfect larva. In *Liriogie micronata* one of the first two or the first four blastomeres may form by delamination a larva with ectoderm and entoderm. In the former case a medusa with the symmetrically arranged tentacles of the adult may result!

The isolated pieces of medusæ eggs develop like the whole egg and not like parts regenerating the rest.

[1] Anatomischer Anzeiger X, Oct., 1894.

Cleavage in the eggs of medusæ thus seems to be a quantitative and not a qualitative process.

Development in Rarified Air.—Professor C. Giacomini[8] has devised an apparatus by which hen's eggs can be subjected to diminished pressure during incubation. The results presented in this preliminary communication are that a pressure of 16 to 17 cm. prevents the normal formation of the vascular organs and incites various monstrosities in the early days of development besides much retarding all the processes of growth.

In later stages embryos are killed by air at that low pressure. These effects seem due to the state of oxygen in the air as they are counteracted by the addition of oxygen to the rarefied air.

The author hopes to have discovered a valuable new aid in the investigation of experimental teratology.

[8] Archiv. Ital. de Biologie, XXII, Dec. 11, 1894.